Final Technical Report and Software Documentation

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13. ABSTRACT (Maximum 200 words)
  FIXCCS was built upon the previous PAMS (Performance Automated Measurement System) research. PAMS is an automated system for measuring performance with the capability to: produce data collection instruments from a database library using a form authoring and editing system; collect and store quantitative and qualitative data including indexing narrative comments in the field; transmit the data to a centralized database for storage and analysis; generate summaries and reports of unit performance; and produce data rollups across units.

  Key features of the PAMS project; A user oriented prototype development process and a broad base of users from the Armed Services communities representing users from operational units, combat training centers and simulation training facilities.

  The overall objective of the FIXCCS project was to perform R&D and test system software. The intent of FIXCCS was to assist in the collection, storage, and analysis of training performance data, building upon and expanding the work previously conducted during the PAMS project. The stated FIXCCS objectives have been achieved.

14. SUBJECT TERMS
Field Interservice Exercise Computerized Collection System (FIXCCS), Observer Controller Communications System (OCCS), Study Plan, Field Test Plan, Market Survey

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FINAL TECHNICAL REPORT AND SOFTWARE DOCUMENTATION

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I. INTRODUCTION

A. Background

The Army Research Institute (ARI) has been engaged in a research and development program sponsored by the Defense Institute for Training Resource Analysis (DITRA) to develop and test a prototype Performance Automated Measurement System (PAMS). The need for new systems and tools to record field training data on the performance of soldiers, teams, and larger units has been extensively reported at the Department of Defense (DoD) and at the individual service level. The PAMS concept grew out of these requirements and was refined based on a systematic program of test and development interactions with a broad base of users.

PAMS is an automated system for measuring performance with the capability to: produce data collection instruments from a database library using a form authoring and editing system; collect and store quantative and qualitative data including indexed narrative comments in the field; transmit the data to a centralized database for storage and analysis; generate summaries and reports of unit performance; and produce data rollups across units. Key features of the PAMS project included a user oriented prototype development process and a broad base of users from the Armed Services communities representing users from operational units, combat training centers and simulation training facilities. PAMS was adopted by the U.S. Army in April 1993, and it was subsequently renamed the Electronic Collection Instrument (ECI) for Army use.

FIXCCS was built upon the previous PAMS research, and focused on training conditions and data collection requirements inherent in more complex interservice exercises. Throughout the project, the title "ECI" was used to describe the Field Interservice Exercise Computerized Collection System (FIXCCS) to DoD participants.

B. Objective

The overall purpose of this effort is to perform research and development and test the FIXCCS in an effort to assist in the collection, storage, and analysis of training performance data. FIXCCS is a new system aimed at broader and more complex sets of user requirements that incorporate new hardware and software advances just becoming commercially available.

C. Project Summary

This document is the Final Report on FIXCCS. It is listed as Deliverable Line Item 0007-07-0011 and encompasses Task 12 of the SOW. As such, it will document the methodology and findings of all phases of the project. The project deliverables outlined in the Statement of Work will be used to describe the project methodology.

Included in this Final Report are the installation diskettes (four), and "Installation Guide" for the FIXCCS Program. The installation diskettes have successfully been tested on six IBM-PC compatible computers. The IBM-PC compatible computers included both 386/16mhz and 486/33 mhz - 66 mhz. The software on the IBM-PC compatible computers included Windows Version 3.1 and MS/DOS Version 6.0 and 6.22. The "Installation Guide" should be used when installing the FIXCCS software.

II. PROJECT METHODOLOGY

A. Study Plan

The "Study Plan" encompasses Task 1 of the SOW. The plan describes how the work was to be conducted, times of initiation and completion of efforts, and dates when products will be delivered. With approval by the COR, the Contractor was permitted to deviate from the plan, as necessary, due to later circumstances, findings, and insights. The due date for the "Study Plan" was 25 August 1992, and was listed as Deliverable Line Item 0007-07-0002. The "Study Plan" was turned in to ARI-Presidio of Monterey (ARI-POM) on 28 August 1992, and accepted on 27 October 1992.

The "Study Plan" outlined the FIXCCS Research Plan, Requirements Specification, Prototype Development, Test and Evaluation, and the project Management Plan. Each of the SOW tasks were defined, and target completion dates and goals were listed. The "Study Plan" was used as the guide for the FIXCCS research, development, and field testing; however, two major deviations of the "Study Plan" were required during the life cycle of the project.

The first major deviation from the "Study Plan" involved the participation of multiple DoD agencies as users of the automated data collection system during the project. The "Study Plan" outlined the intent to work with the U.S. Army and U.S.M.C. in order to involve a broad base of users from the Armed Services communities. During the early stages of the project it was identified that the U.S.M.C was unable to provide the necessary resources and environment to support the FIXCCS project. The U.S. Air Force replaced the U.S.M.C. due to their involvement in the BDM and ARI research effort project "Systems for an Interservice Exercise Measurement and Feedback System (SINEX)".

The second major deviation from the "Study Plan" involved the Milestone Schedule for FIXCCS. The National Training Center (NTC) at Fort Irwin, CA, and the Joint Readiness

Training Center (JRTC) at Fort Polk, LA, were used as the FIXCCS test centers due to their interest in utilizing technology to capture data and information during field rotations. In order to take advantage of this opportunity, multiple field trails were conducted, with software and hardware upgrades performed during and between each of the field trials. As a result of performing multiple field trials, several SOW deliverables were completed and delivered to ARI-POM after the projected Milestone dates.

B. User Functional Requirements Specifications

The "User Functional Requirements Specifications" encompasses Task 2 of the SOW. The "User Functional Requirements Specification" was based on requirements identified by selected users, determined through direct discussions and demonstrations with the users.

The due date for the "User Functional Requirements Specifications" was 28 October 1992, and was listed as Deliverable Line Item 0007-07-0003. The "User Functional Requirements Specifications" was combined with the "Market Survey" (Task 3, line item 0007-07-0004) and the "Documentation of Prototype" (Tasks 4 and 5, line item 0007-07-0005). It was turned in to ARI-POM on 17 May 1993, and accepted on 21 May 1993.

Specific user requirements were determined to be:

1.) Highly variable within and across training environments:

    a. Diversity of desired uses/functions.

    b. Varying needs depending on physical location and focus.

    c. Evolving as technology improves and training feedback procedures are refined.

    d. Require trade-offs since all are not mutually reinforcing or compatible.

2.) System must be flexible and adaptable to meet variety of user needs:

    a. Easy to use.

    b. Requires minimal training.

    c. Intuitively obvious for naive computer users.

    d. Able to withstand field use.

Specific details on software and hardware requirements are identified in "Documentation Of Prototype Requirements And Configuration Description" (Tasks 4 and 5,

line item 0007-07-0005) listed below.

The user requirements identified above were consistently applied throughout all field testing and development. Their validity was assessed throughout the project and were determined to be essential requirements for FIXCCS and any similar projects.

C. Market Survey

The "Market Survey" encompasses Task 3 of the SOW. The survey was performed on commercially available hardware and software to identify new technology and assess the appropriateness of technology using criteria established by the "User Functional Requirements Specifications".

The due date for the "Market Survey" was 15 January 1993, and was listed as Deliverable Line Item 0007-07-0004. The "Market Survey" was combined with the "User Functional Requirements Specifications" (Task 2, line item 0007-07-0003) and the "Documentation of Prototype" (Tasks 4 and 5, line item 0007-07-0005). It was turned in to ARI-POM on 17 May 1993, and accepted on 21 May 1993.

The market survey findings were:

1.) Portable computer units (laptops, hand-held) rapidly coming on market with increasing capability and lower price.

2.) Greater number of options occur with MS-DOS based machines.

3.) Ruggedized units generally offer less capability at much higher costs.

Recommendations identified as a result of the market survey were:

1.) Consider currently available hardware as temporary platform and expect subsequent replacement with more capable machines.

2.) Focus primarily on software development.

3.) Increase existing hardware capability to broaden tryout capability:

a. 486 grid "combo" systems (pen and keyboard entry).

b. 2 Zenith B&W laptops (keyboard and mouse entry).

c. 2 Sharp color laptops (keyboard and mouse entry).

d. Cellular phone and modem transceiver and external modem/fax for remote transmission.

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e. Power supplies for vehicle recharging.

4. Retain option to acquire limited additional equipment as technology advances and user requirements evolve.

The above recommendations were developed to support the initial field trial scheduled at the NTC in August 1993. In addition to the "Combo" systems, Zeniths, and Sharps, one hardened Tusk was also used. During field trials at Nellis AFB, JRTC, and NTC in early 1994 a second market survey was conducted to take advantage of new systems available on the market. As a result of this second survey, a single system, the Dauphin DTR-1, was selected.

The recommendations for use of a cellular phone, modem transceiver, and external modem/fax for remote transmission were not pursued for the initial field trial. During the early 1994 field trials, modems were used at the NTC to test the FIXCCS remote data transmission capability over the NTCs communications systems.

D. Documentation Of Prototype Requirements And Configuration Description

The "Documentation of Prototype Requirements and Configuration Description" encompasses Tasks 4 and 5 of the SOW. The documentation was based on the formulation of requirements for prototype development and addressed hardware and software components for the system based on user needs and currently available hardware. Additionally, configuration requirements addressed both hardware and software that meets functional requirements, including specific applications software required.

The due date for the "Documentation of Prototype Requirements and Configuration Description" was 28 February 1993, and listed as Deliverable Line Item 0007-07-0005. The "Documentation of Prototype Requirements and Configuration Description" was combined with the "User Functional Requirements Specifications" (Task 2, line item 0007-07-0003) and the "Market Survey" (Task 3, line item 0007-07-0003). It was turned in to ARI-POM on 17 May 1993, and accepted on 21 May 1993.

Primary hardware requirements identified were:

1.) Base computer at central location for development, administrative and management purposes.

2.) Portable computers for field AAR or THP preparation.

3.) Field Computers:

a. Light-weight and compact size for personal transport.

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    b. Vehicle-mounted.

  4.) Reliable power source:

    a. Battery recharging in the field.

    b. Use of vehicle power source.

  5.) Operability within field environment.

  6.) Remote data transmission.

  7.) Interface/compatibility with existing systems.

Primary software requirements identified were:

  1.) Develop new data collection instruments.

  2.) Adapt existing data collection instruments.

  3.) Input data collection content from automated or hard copy sources.

  4.) Easy to use.

  5.) Requires minimal training.

  6.) Intuitively obvious for relatively naive computer users.

  7.) Flexible and adaptable.

  8.) Usable under field conditions.

  9.) Build variety of data collection formats (task performance checklists, statistical data sheets, narrative comments).

  10.) Store reference materials (e.g. ARTEP MTPs, FMs) and access by key word.

  11.) Create and process text (free form and report templates).

  12.) Display and annotate tactical map and battle graphics.

  13.) Use variety of input methods including mouse, stylus, keyboard, and voice.

  14.) Send messages to other devices users.

15.) Prepare descriptive data summaries:

    a. Quick field turn around for individual collector - 30 minutes.

    b. Within 2 hours from multiple collectors for use in AARs.

16.) Build data files for more extensive analysis.

17.) Prepare text files which can be integrated into larger product (e.g. THP).

The hardware and software requirements were consistently applied throughout all field testing and development. Their validity was assessed throughout the FIXCCS project and were determined to be essential requirements for FIXCCS and any similar projects.

E. Configured And Tested Software

The "Configured and Tested Software" encompasses Task 6 of the SOW. The software configuration was based on functional requirements. The preliminary R&D software design was used during field trials to determine the feasibility and validity of a detailed design.

The due date for the "Configured and Tested Software" was 16 November 1993, and listed as Deliverable Line Item 0007-07-0006. The "Configured and Tested Software" was turned in to ARI-POM on 19 November 1993, and accepted on 3 January 1994.

The "Configured and Tested Software" contained in the deliverable reflect substantial changes made as a result of the NTC field trial in August 1993. The software used during the August 93 field trial was DOS/Character based, in Clipper/ Advanced Revelation Language. The program was composed of two elements: a data collection module used in the field by the end user; and a data assimilation/reporting module to be used in a 'home base' situation. The field trial resulted in software modifications recommended by the users.

Based on user comments and an internal BDM review of improved "off-the-shelf" software, the FIXCCS software was rewritten into Graphical User Interface and Windows. This software rewrite expanded the capabilities of FIXCCS by providing advantages through operating in a Windows programming environment. Additional advantages included access to Windows program-to-program interconnectivity tools and access to Visual Basics incorporated data handling and reporting tools.

A separate software program was also written to integrate doctrinal FMs and ARTEP MTPs into the FIXCCS through an ARTEP Reader.

This deliverable contained the source code and documentation reflected in the software program rewrite. The software went through additional minor modifications as a result of the field trials conducted during the period January-May 1994 at the NTC, JRTC, and Nellis AFB. The final FIXCCS source code and documentation, reflecting modifications integrated

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following the delivery of "Configured and Tested Software" (Task 6, line item 0007-07-0006), is contained in "Draft Final Report Including Detailed Functional Specifications for Prototype" and "Final Software Documentation" (Task 9, line item 0007-07-0010) below.

F. Embedded Instructional Program

The "Embedded Instructional Program" encompasses Task 8 of the SOW. The tutorial was developed based on a task analysis to identify the skills required to operate the system. The "Embedded Instructional Program" was implemented in code and integrated into the software system.

The due date for the "Embedded Instructional Program" was 15 August 1994, and listed as Deliverable Line Item 0007-07-0007. The "Embedded Instructional Program" was turned in 27 January 95.

ARI-POM sponsored and conducted a field trial of the FIXCCS at the CMTC at Hohenfels, Germany, from 4 September to 11 October 1994. The FIXCCS chief programmer deployed to CMTC to provide technical support for the field trial. Due to preparation requirements and the length of the field trial, the COR approved a modification to the delivery due date.

G. Draft Software Training And Documentation

The "Draft Software and Documentation" encompasses Task 7 of the SOW. The software training and documentation was based on the results of the final FIXCCS field trials conducted during the period January-May 1994 at the NTC, JRTC, and Nellis AFB. Detailed software configuration was implemented in code and all software modules were integrated and tested.

The due date for the "Draft Software Training and Documentation" was 31 July 1994, and listed as Deliverable Line Item 0007-07-0009. ARI-POM sponsored and conducted a field trial of the FIXCCS at the CMTC at Hohenfels, Germany, from 4 September to 11 October 1994. The FIXCCS chief programmer deployed to CMTC to provide technical support for the field trial. Due to preparation requirements and the length of the field trial, the COR approved a modification to the delivery due date. The "Draft Software Training and Documentation" formal paperwork was turned in to ARI-POM on 1 November 1994, and accepted on 22 November 1994.

The FIXCCS software program was loaded onto one of the CORs FIXCCS computers, a Dauphin DTR-1, on 15 July. The FIXCCS software included the Player/Builder application, Quick-Report application, Pocket-Text application and all associated context sensitive Help files. Installation also included example forms used previously at NTC for demonstration purposes.

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The COR used the DTR-1 and FIXCCS software for a demonstration to the CMTC leadership at Hohenfels, Germany on 29 July 1994. The demonstration of the FIXCCS software and hardware resulted in the CMTC approving the field trial plan during the September-October time frame. The COR agreed to accept the software loaded into the DTR-1 for the August demonstration and loaded into the 25 DTR-1s used in the field trial as satisfying the deliverable requirements for "Draft Software Training and Documentation".

H. Field Test Plan

The "Field Test Plan" encompasses Tasks 10 and 11 of the SOW. This deliverable provided an audit trail of all FIXCCS testing. It covered the in-house beta test of the system, including all hardware components and all software modules. Additionally, it included all support planning for and conduct of field trials performed throughout the FIXCCS project.

The due date for the "Field Test Plan" was 15 July 1994, and listed as Deliverable Line Item 0007-07-0008. ARI-POM sponsored and conducted a field trial of the FIXCCS at the CMTC at Hohenfels, Germany, from 4 September to 11 October 1994. The FIXCCS chief programmer deployed to CMTC to provide technical support for the field trial. Due to preparation requirements and the length of the field trial, the COR approved a modification to the delivery due date. The "Draft Software Training and Documentation" formal paperwork was turned in to ARI-POM on 19 September 1994, and accepted on 24 October 1994.

The "Field Test Plan" covered in detail the field trials of the FIXCCS. A review of the field trials conducted is as follows:

SITE	DATES	DAYS	# USERS	DoD SERVICE
NTC	7-21 Aug 93	14	6	U.S. Army
JRTC	11-29 Mar 94	19	10	U.S. Army
JRTC	11-29 Mar 94	19	4	U.S. Air Force
NTC	6-19 Mar 94	14	37	U.S. Army
NTC	10-23 Apr 94	14	32	U.S. Army
NTC	8-21 May 94	14	6	U.S. Army
NTC	5-18 Jun 94	14	3	U.S. Air Force
Nellis AFB	5-18 Jun 94	14	3	U.S. Air Force

The "Field Trial Plan" included information on software updates performed as a result of beta testing prior to each field trial as well as software de-bugging which occurred during and after each field trial.

Field trials were performed to achieve two objectives. The first, to conduct the field trials with separate DoD services, was achieved. Ten U.S. Air Force members, Colonel to MSG, used the FIXCCS for a total of thirty-three days infield trials conducted at the JRTC,

NTC, and Nellis AFB. Fifty-three U.S. Army members, Colonel to SFC, used the FIXCCS for seventy-five days in trials conducted at the NTC and JRTC.

The second field trial objective, to have a broad base of users test the FIXCCS in a field environment, was achieved. A total of 103 soldiers and airmen (officer and enlisted) and civilians participated in the field trials. These trials resulted in the FIXCCS being used for a total of 108 days in harsh and demanding field conditions.

During field trials at the NTC in April and May 1994, testing was performed to identify requirements necessary for remote transmission of FIXCCS data. Modems were purchased and, with the FIXCCS software, modified to allow data to be transmitted over the NTC Observer Controller Communications System (OCCS) from a FIXCCS computer in the field to a base station in garrison. Technical experts from the modem manufactor provided assistance to BDM programmers during the testing period. By 20 April 1994, success had be achieved in transmitting FIXCCS files by modem over the OCCS. Several files were successfully transmitted, and the data received by the base station was loaded into an SPSS/FOXPRO data based being used to record information for DESERT HAMMER VI, an Advanced Warfighting Demonstration being conducted at the NTC. Although the test was successful, remote transmission capability was not included in formal field trials.

The use of the FIXCCS at CMTC is not included in the field trials plan. The software used at CMTC represents the final FIXCCS software coding, developed and refined based on previous field trials.

I. "Draft Final Report Including Detailed Functional Specifications For Prototype" and "Final Software Documentation"

The "Draft Final Report Including Detailed Functional Specifications for Prototype" and "Final Software Documentation" deliverables, as outlined in the SOW, have been combined due to the direct linkage between the two. The deliverables, as combined, are listed as "Draft Technical Report" and encompasses Task 9 of the SOW.

Although the deliverable is listed as "Draft", it includes the technical documentation for the FIXCCS prototype and its functional specifications. The "Draft Technical Report" includes all software source coding except the "Embedded Instructional Program", which is listed as a separate deliverable.

The due date for the "Draft Technical Report" was 30 August 1994, and listed as Deliverable Line Item 0007-07-0010. ARI-POM sponsored and conducted a field trial of the FIXCCS at the CMTC at Hohenfels, Germany, from 4 September to 11 October 1994. The FIXCCS chief programmer deployed to CMTC to provide technical support for the field trial. Due to preparation requirements and the length of the field trial, the COR approved a modification to the delivery due date. The "Draft Technical Report" was turned in to ARI-POM on 23 November 1994, and accepted on 9 December 1994.

J. Hardware To Support Expanded Field Test Activities

The "Hardware to Support Expanded Field Test Activities" encompasses Task 1 of the Modified SOW. The deliverable detailed hardware, software, and equipment component purchase documentation requirements to continue FIXCCS research and development following the initial NTC field trial in August 1993. Included were the purchase of modems to test the FIXCCS remote transmission capability at NTC during the April-May field trials.

The due date for "Hardware to Support Expanded Field Test Activities" was 19 November 1993, and listed as Deliverable Line Item 0007-07-0012. The "Hardware to Support Expanded Field Test Activities" was turned in to ARI-POM on 24 January 1994 and accepted on 26 January 1994.

K. Briefing Documenting Support To Expanded Field Test Activities

The "Briefing Documenting Support to Expanded Field Test Activities" encompasses Task 3 of the Modified SOW. This deliverable required the development of a briefing package used to describe the FIXCCS project. As such, the briefing contained the following topics:

1.) Program Background (FIXCCS/ECI).

2.) ECI System Description.

3.) ECI System Key Features.

4.) ECI Software.

5.) ECI Field Trial Hardware Platforms.

6.) ECI Field Trial Objectives.

7.) ECI Field Trials.

The due date for the "Briefing Documenting Support to Expanded Field Test Activities" was 31 July 1994, and listed as Deliverable Line Item 0007-07-0013. The "Briefing Documenting Support to Expanded Field Trial Activities" was turned in to ARI-POM on 28 January 1994, and accepted on 9 February 1994.

L. Additional Equipment Acquisition Based On Results Of Field Trials

The "Additional Equipment Acquisition Based on Results of Field Trials" encompasses

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Task 2 of the Modified SOW.

The due date for the "Additional Equipment Acquisition Based on Results of Field Trials" was 31 August 1994, and listed as Deliverable Line Item 0007-07-0014. ARI-POM sponsored and conducted a field trial of the FIXCCS at the CMTC at Hohenfels, Germany, from 4 September to 11 October 1994. The FIXCCS chief programmer deployed to CMTC to provide technical support for the field trial. Due to preparation requirements and the length of the field trial, the COR approved a modification to the delivery due date. The "Additional Equipment Acquisition Based on Results of Field Trials" was turned in to ARI-POM on 23 December 1994.

M. Findings and Results

The U.S. Army was the predominate DoD service which participated in the FIXCCS project. Although the U.S. Marine Corps was unable to participate, as initially identified, the involvement of the U.S. Air Force, and their satisfaction with the FIXCCS system, demonstrated that FIXCCS has utility DoD wide.

The user requirements (outlined in Tasks 3, 4, and 5 of the SOW, page 3 of this report), identified early in the FIXCCS program, were continually validated by DoD field trial participants throughout all testing. These user requirements should serve as a guide to build upon for any future computer hardware and software projects initiated by ARI where DoD is involved.

The primary hardware and software requirements (outlined in Task 2 and 3 of the SOW, page 5-6 of this report), also identified early in the FIXCCS program, were validated during every field trial.

Hardware must be durable and reliable. The costs associated with ruggedizing a hardware systems would be high since those systems would have to operate in a variety of field environments. The hardware used during the FIXCCS project was not ruggedized, and when users were provided with sturdy and padded carrying cased, the hardware generally survived. The survival of off-the-shelf non-ruggedized hardware, when properly protected, provides a significant cost savings.

Software capability, the essence of the FIXCCS project, went through extensive testing and development. The FIXCCS software was modified based on user input on ease of use and on definitive analysis of what the user needed the software to do. The final FIXCCS software allows users to record all forms of information while in a field environment, with the ability to download the information into a variety of data bases for analysis. The ARTEP Reader, providing users with quick and easy access to doctrinal materials, was sited by users as a significant advantage. No longer would user be required to carry bulky manuals; additionally, the ARTEP reader allows immediate access to specific portions of manuals by providing a word or sentence search feature.

The ability of the FIXCCS to transmit information over communications systems, successfully accomplished at the NTC but not tested by DoD users, demonstrated the FIXCCS utility of data collection in a field environment. This capability allows users to transmit information and data over great distances for uploading into a data base and for rapid analysis. All users identified this feature as essential to the data collection effort by reducing the time required, in some cases saving several hours of travel.

III. CONCLUSION

The stated FIXCCS objectives have been achieved. Extensive work has been performed on the FIXCCS software to provide users the ability to collect information in the field by taking advantages of available technology. A wide range of users, from two separate DoD services, directly participated in the research and development effort. The FIXCCS was employed in several field trials and was demonstrated to achieve the data collection requirements demanded by users.

The overall objective of the FIXCCS project was to perform R&D and test system software. The intent of FIXCCS was to assist in the collection, storage, and analysis of training performance data, building upon and expanding the work previously conducted during the PAMS project. FIXCCS focused on training conditions and data collection requirements inherent in more complex interservice exercises, aimed at broader and more complex sets of user requirements that incorporate new hardware and software advances just becoming commercially available.

The continued use of the FIXCCS system at the CMTC in Hohenfels, Germany, since September 1994, indicates that the system is both reliable and achieves the needs stated by users and as outlined in the Statement of Work.

The FIXCCS has demonstrated its utility at the U.S. Army's CTCs and, both U.S. Army and U.S.A.F. users have expressed the need to have the system available for use immediately. As a result of the FIXCCS project, the following recommendations are made:

    1.)   That ARI continue R&D efforts to test the transmission capability over the Observer-Controller Communications System (OCCS). Although this feature was successfully performed, it must undergo detailed field trials, with several users involved, and with the information and data loaded into a several data bases. Additionally, R&D should be performed to allow FIXCCS hardware and software to communicate over other communications systems currently in use by DoD.

    2)   That ARI begin immediately to coordinate with all DoD service R&D departments for implementation of the FIXCCS.

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